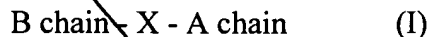


What is claimed is:

1. A single-chain insulin analog compound of formula (I) having the properties of greater insulin receptor binding activity than proinsulin and less insulin receptor binding activity than insulin:



wherein:

B and A chains are the human insulin chains, respectively, or functional analogs thereof; and

X is a joining peptide of from 5 to 18 amino acids.

2. The compound of claim 1, wherein X is from 6 to 9 amino acids.

3. The compound of claim 2, wherein X has a formula $U_1-Z_n-Y_m-Z_1-U_n$, wherein
U is an arginine or lysine residue;
Z is an amino acid residue;
Y is a peptide;
1 is an integer of 2-n;
n is an integer of 0, 1 or 2; and
m is an integer of 2 to 5

4. The compound of claim 3, wherein Z is glycine; and Y is glycine-proline-glycine.

5. The compound of claim 3, wherein Z is glycine; and Y is alanine-proline-glycine-aspartic acid-valine.

6. The compound of claim 3, wherein Z is glycine; and Y is tyrosine-proline-glycine-aspartic acid-valine.

7. The compound of claim 3, wherein Z is glycine; and Y is histidine-proline-glycine-aspartic acid-valine.

8. A polynucleotide encoding the single-chain insulin analog according to claim

3 9. A recombinant vector comprising the polynucleotide according to claim ²8.

4 10. The vector according to claim ³9, wherein said vector is a plasmid.

5 11. The vector according to claim ³9, wherein said vector is a virus.

6 12. The vector according to claim ⁵11, wherein said virus is adeno-associated virus.

7 13. The vector according to claim ³9, comprising an inducible promoter.

sub 14. The construct according to claim 13, wherein said promoter is regulated by glucose.

9 15. The vector according to claim ⁸14, wherein said promoter is a pyruvate kinase gene promoter.

10 16. The vector according to claim ⁹15, wherein said promoter is a hepatocyte-specific L-type pyruvate kinase gene promoter.

11 17. A cell line transformed with the vector according to claim ³9.

18. A method for treating a patient suffering from diabetes comprising:

a) generating a recombinant viral or plasmid vector comprising a polynucleotide encoding a single-chain insulin analog operatively linked to a promoter; and

b) introducing said recombinant viral or plasmid vector to said patient, such that expression of said polynucleotide within said patient results in remission of diabetes.

19. The method according to claim 18, wherein said viral vector is adeno-associated virus.

20. The method according to claim 19, comprising an inducible promoter.

21. The method according to claim 20, wherein said promoter is regulated by glucose.

22. The method according to claim 19, wherein the dosage of said viral vector is at least about 10^{11} viral particles.

23. A method for treating a patient suffering from diabetes comprising administering the compound of claim 1 to a patient in need thereof.

24. The method according to claim 18, wherein said diabetes is type I diabetes.

25. The method according to claim 18, wherein said vector is introduced to the patient through the cell line according to claim 17.

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